THE HISTORY AND STATISTICS OF AMERICAN WATER-WORKS.

BY J. JAMES R. CROES, M. AM. SOC. C. E.

(*Continued from page 411.*)

CCCCXVIII.—LOS ANGELES, CAL.

Los Angeles, California, in lat 34° 3′ 10″ N., long. 118° 4′ 40″ W., on the Los Angeles River, is in a valley which is about a mile wide at the northern end where the river breaks through the hills, 100 to 309 ft. high, which diverge from that point and continue to the sea coast, 16 miles distant.

Settled in 1871, it was incorporated as a city in 1858. Water-works were begun by a private company in 1862 and improved in 1868.

The supply is taken from the Los Angeles River. A brush and sand wing-dam diverts the water into an open ditch excavated in earth, which conveys the water 7 miles to a reservoir formed by a masonry dam across a canon. It now holds 7,000,000 gallons, but its capacity is being increased to 10,000,000 gallons by excavating its bed to solid rock.

Distribution is by 20 miles of pipe, of from 22 to 1½ in. in diameter, with 60 fire hydrants, 200 gates and 1,726 taps. The city does not pay for hydrant service.

The distribution-pipes first used were of sheet-iron, cement lined. Many of these have failed, the asphalt-coating having been broken in laying. Where covered with cement, these pipes have not yielded. Pipes of No. 12 sheet-iron have been used, and also lap-welded boiler tubing. All extensions and repairs are now made with cast-iron pipe. For service pipes galvanized iron is used.

The population in 1880 was 11,311. It is now estimated to be 19,000. The daily consumption is 1,500,000 gallons. It sometimes is increased to 2,500,000 gallons in summer.

The capital stock of the company is $330,000. The works have cost $425,000. The bonded debt is $95,000 at 7 per cent. interest. No further financial statements are given.

Fred. Eaton, C. E., is the Engineer and Superintendent.

CCCCXIX.—GENESEO, ILL.

Geneseo, Illinois, in lat. 41° 20′ N., long. 90° 10′ W., is on level ground in an agricultural district.

Settled in 1837, it was incorporated as a town in 1855 and as a city in 1865.

Water-works were begun for the city by P. B. Perkins in 1879 and completed in September, 1882. The supply is taken from a well of 6-in. bore, 800 ft. deep. The principal yield is from a stratum 120 ft. below the surface. The water rises to within 25 ft. of the surface and is then pumped by a Dayton cam pump directly into the mains, with ordinary pressure of 20 lbs., and fire pressure of 60 to 80 lbs. A cistern holding about 80,000 gallons, under the pump house, is kept filled to be used in case of sudden demand.

Distribution is by 1,800 ft. of 6-in. cast-iron pipe, with 12 fire hydrants, 1 gate and 23 taps. Wrought-iron service pipes are used.

The population in 1880 was 4,080. The daily consumption is not known yet.

The works cost $7,000. The bonded debt is $4,000 at 6 per cent. The works were erected mainly for fire protection to the business part of the city.

The city council controls the works. Alexander White is the Superintendent.

CCCCXX.—NIAGARA FALLS, ONT.

Niagara Falls, Ontario, Canada, is on the east side of the Niagara River, below the Falls.

Settled in 1852, it was incorporated as a town in 1857. Water-works were built as a private enterprise in 1858 by Samuel Zimmerman, taking the supply from the Niagara River and lifting it 160 ft. by a double-acting piston pump, driven by a crank on the shaft of an overshot water-wheel 8 ft. in diameter. The wheel takes its water from a race supplied from the river. The water-level in the river fluctuates a good deal, and in winter the ice is very troublesome. Sometimes an easterly wind in winter keeps the water out of the race. The first pump ran for 21 years without reboring. The present one has been rebored after 7 years' use. The force main is of 6-in. cast-iron pipe, 2 miles long, and terminates in a stand-pipe in a reservoir, holding 1,500,000 gallons and lined with brick paving. The reservoir has broken away twice. There is another reservoir of 30,000 gallons. Distribution is by 3 miles of 6 and 3-in. cast-iron pipe, with 3 fire hydrants, 8 fire cisterns and 200 taps. The town pays $75 per year for hydrants. Service pipes are chiefly of wrought iron. The mains are now so arranged with a connection between the force and distributing-mains outside the reservoir, with check-valves, that water can be pumped directly into the mains without passing through the reservoir. The population is 2,500, and the daily consumption 90,000 gallons. The works have cost $100,000. The expenses of maintenance were $200 and the receipts $1,400 in 1881.

The works are owned by Lewis & Biggar. J. B. Lewis is the Manager.

CCCCXXI.—WALTON, N. Y.

Walton, New York, in lat. 42° 13′ N., long. 75° 5′ W. on the Delaware River, is in a valley about a mile wide, surrounded by abrupt hills from 400 to 800 ft. high. Three large brooks enter the valley from the North and unite with the Delaware River, which enters the village from the East and at its centre turns to the South.

Settled in 1784, it was incorporated in 1851. Water-works were built by a private company in 1879 after plans of William B. Rider, C. E., taking the supply from a stream draining 8 square miles, a mile and a half from the village. An impounding reservoir of 2½ acres area and 206 ft. above the village is formed by a dam across the stream 210 ft. long and 18 to 22 ft. high. The dam is of earth with inside slope of 2 to 1 and external slope of 1½ to 1, with a heart of dry rubble 12 ft. thick at bottom, and 5 ft. at top, backed with a 3 ft. wall of stone laid in cement. The lower face of the overtall, 60 ft. long, is laid up with stone in steps of 1 ft. rise and breadth. The water is drawn from the reservoir through a chamber in the dam, 4 by 10 ft., and 18 ft. deep. The chamber is in these compartments, separated with wire screens. The first compartment, 6 ft. thick, is filled with charcoal, the second, 16 in. thick, with sponge. After passing through the charcoal and sponge the water enters the third compartment, 4 ft. by 2 ft. 8 in., whence it is conveyed to the village through 165 ft. of 10-in. and 8,814 ft. of 8-in. cast-iron pipe. The filter above described will pass 30,000 gallons per day.

Distribution is by 3.76 miles of cast-iron pipe of from 6 to 1¼-in. diameter with 22 fire hydrants, 21 gates and 90 taps. Service pipes are principally of enameled iron, with some of galvanized, some of plain iron and some of lead.

The population in 1880 was 1500. The daily consumption is 30,000 gallons.

The capital stock of the company is $15,000. The works have cost to the present time $17,500. There is no debt. The expenses of maintenance in 1881 were $25, and the receipts $1,000

Strong Comstock is President, and V. C. Wood, Secretary of the company, and John S. Ells, Superintendent.

CCCCXXII.—DAVENPORT, IA.

Davenport, Iowa, in lat. 41° 30′ N., long. 90° 34′ W., on the Mississippi River, is at the foot of and on the slope and top of a bluff rising to 180 ft. above low water. The rise of the river in high water is 18.75 ft.

Settled in 1836, it was incorporated as a city in 1839. Water-works were built in 1874 by Michael Donahue, by private enterprise, taking the supply from the Mississippi River.

A brick conduit, laid with Portland cement, 3½ by 3 feet inside, extends into the river and under its bed for 250 ft. from low-water mark. At the shore end is a well, 15 ft. in diameter and 30 ft. deep, from which the water is pumped directly into the mains, under 85 lbs. ordinary pressure and 110 to 140 lbs. fire pressure. For eight years the pumps were two horizontal piston pumps of 17 in. bore and 72 in. stroke, built by Todd & Rafferty, of Paterson, N. J., driven by gearing from two horizontal engines, with steam cylinders of 24 in. bore and 36 in. stroke, built by M. Donahue.

In 1882 the pumps were replaced by two Clapp & Jones' plunger pumps of 12 in. bore and 36 in. stroke, connected directly with the engine cylinders. These work satisfactorily.

Distribution is by 22 miles of cast-iron pipe of from 14 to 4 in. in diameter, with 251 fire hydrants, 65 gates and 780 taps. There are 178 meters in use. Each fire hydrant has a shut-off gate. The city pays $70 per year for each fire hydrant. This rate will continue until April, 1884. For the succeeding five years it will be $50 per hydrant. Galvanized iron service pipes are used.

The population in 1880 was 21,834, and the daily consumption was 1,700,000 gallons.

The capital stock of the company is $1,000,000. The works have cost $550,000. There is no bonded debt. No further financial statements are given. Michael Donahue is President and William Moffat Secretary of the company.

CCCCXXIII.—COLORADO SPRINGS.

Colorado Springs, Colorado, in lat. 38° 50′ N., long. 104° 49′ 8″ W., on Monument Creek, is on a level plateau 5 miles from the base of the Rocky Mountains.

Settled in 1871, it was incorporated in 1872.

Water-works were built in 1878 by the city after plans of W. B. Sherman, taking the supply from Ruxton's Creek, which is fed from springs and perpetual snow on the east slope of Pike's Peak. A dam across the stream, 7 miles from the city, diverts the water into a 10-in. cast-iron pipe, which conveys it 6 miles to a distributing reservoir, holding 2,000,000 gallons, which is formed by a dam across a small ravine; about 150 ft. above the city.

The main to the city is of 8-in. cast-iron pipe, and there are 11 miles of 6 and 4-in. distribution mains of cast iron, with 48 fire hydrants and 900 taps. Service-pipes are of wrought iron.

The population in 1880 was 5,000. The daily consumption is not known. A great deal of water is used for irrigation of lawns.

The cost of the works was $105,000, of which $25,000 was expended in relaying the mains which at first had not been placed deep enough, and consequently froze and burst.

The bonded debt is $90,000 at 7 per cent. interest. The expenses of maintenance in 1881 were $2,000 and the receipts $12,000.

The works are controlled by the water committee of three of the City Council. Morton Parsons is the Superintendent.

CCCCXXIV.—CHESHIRE, MASS.

Cheshire, Massachusetts, in lat. 42° 33′ N., long. 73° 11′ W. is at the head of one of the main branches of the Hoosac River, in a valley between high mountains. It was settled in 1867. The village is not incorporated. Water-works were built by a private company in 1875 after plans of William E. Pettee, C. E., taking the supply from Thunder Brook, 1 mile west of the village.

A stone masonry dam 40 ft. long and 12 ft. high across a rocky gorge, formed an impounding reservoir of about five-eighths of an acre area, at 200 to 280 ft. above the village. The water is drawn from the pond, through a chamber in the dam, 6 by 12 ft., in which are gravel and charcoal partitions, between wire screens. Distribution is by 5¾ miles of cast-iron pipes of from 8 to 3 in. diameter and 1½ miles of 2 in. wrought-iron pipe. There are 18 fire hydrants and 260 taps. The town does not pay for hydrants, but subscribed for $3,000 of the stock of the company. Service pipes are of wrought-iron. The mains are laid 6 ft. deep and covered with 1 ft. of charcoal braize to prevent freezing.

The consumption is not known, but is large in proportion to the size of the village, as a railroad company, two iron works, a sand company and a creamery are supplied. The population is 1,200.

The capital stock of the company is $15,000. The works have cost to the present time $17,800. The annual expenses are about $50 and the receipts $1,500. There is no debt.

R. A. Burget is the General Manager.

CCCCXV.—CANAAN, CONN.

Canaan, Connecticut, in lat. 42° 2′ N., long. 73° 20′ W., is 1 mile west of the Housatonic River on a sandy plain broken by limestone ridges rising from 10 to 100 ft. above its level. The town is 670 ft. above the sea.

It was settled in 1740.

Water-works were built in 1879 by a private company, after plans of William E. Pettee, C. E., taking the supply from a mountain spring 150 ft. above the village. A reservoir of half an acre area and is formed by a stone masonry dam 150 ft. long and 12 ft. high. The water is not filtered. A line of 6-in. and 4-in. cast-iron pipe convey it 1½ miles to the plain and then there is ¼ mile of 4-in. pipe through the main street. Branches of 2-in. and 1-in. pipe of 2 miles aggregate length have been laid by individuals and given to the company in consideration of free use of the water for terms of from 10 to 20 years. There are 6 fire hydrants and 150 taps. Service pipes are of wrought iron. The population is 700. The consumption is not known.

The capital stock of the company is $5,000. The works have cost $7,250. There is no debt. The annual expenses are $50 and the receipts $700.

Frederick Watson is the Superintendent.

(TO BE CONTINUED.)

The receipt of statistics as follows is acknowledged with thanks:

From E. B. Noyes and W. P. Jewett, statistics and water rates of Colorado Springs, Col., W. W.

From M. Scammell, Secretary and General Manager, statistics and water rates of Tiffin, O., W. W.

From J. B. Lewis, statistics and water rates of Niagara Falls, Ont., W. W.

From Alex. White, Superintendent, statistics and water rates of the Geneseo, Ill., W. W.

From Fred. Eaton, Engineer and Superintendent, statistics of Los Angeles, Cal., W. W.

From Strong Comstock, President Water Co., statistics of Walton, N. Y., W. W.

From M. Donahue, President, statistics of Davenport, Ia., Water-works.

From Isaac S. Cassin, C. E., statistics and water rates of Pottstown, Pa., Water-works.

From M. M. Tidd, C. E., statistics of water-works of Clinton, Mass.

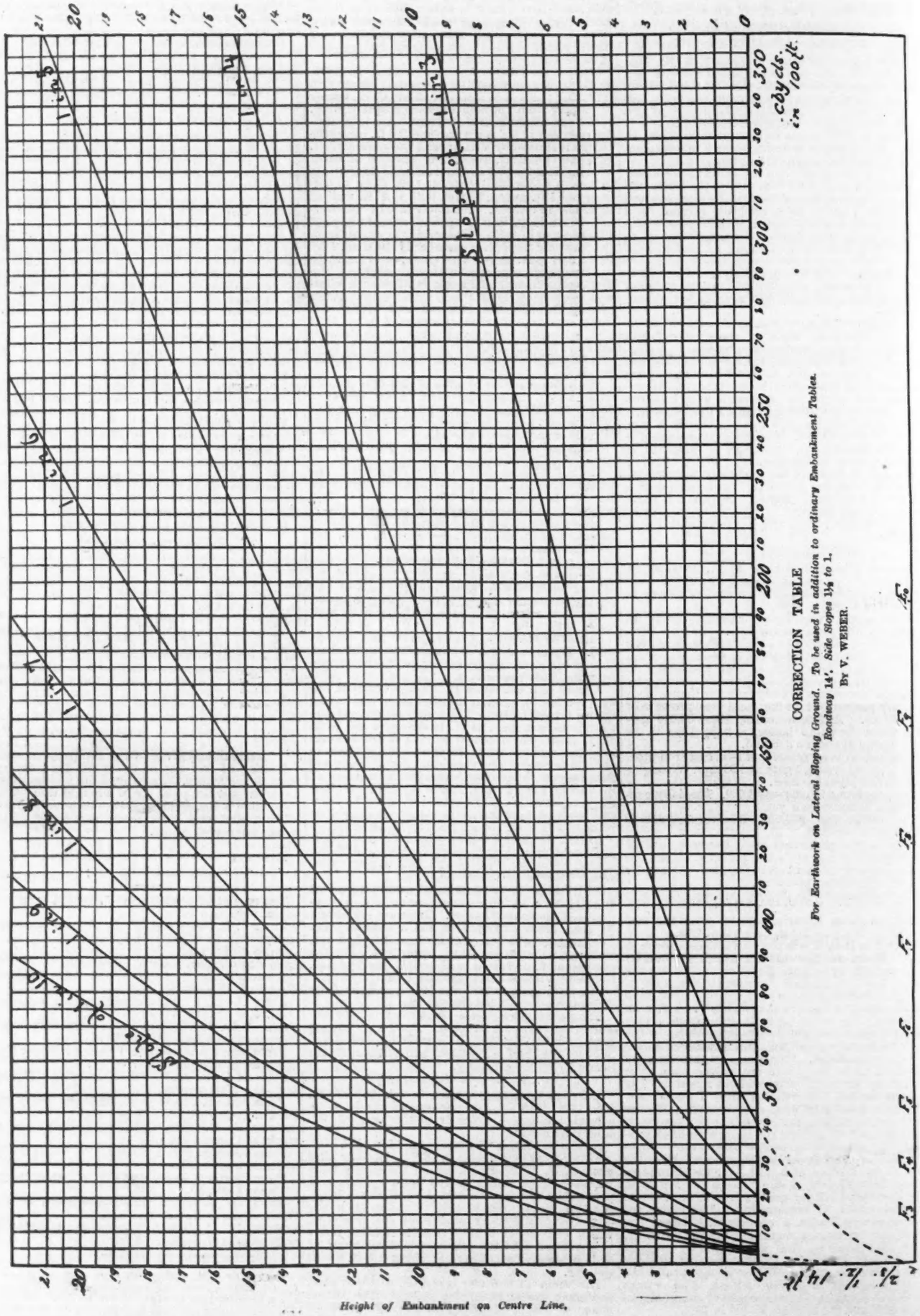
From Elbridge Howe, statistics of water-works of Marlborough, Mass.

From Carroll S. Page, statistics of water-works of Hyde Park, Vt.

From an unknown hand, description of the Gowen City, Dak., artesian well.

From D. C. Dixson, Controller, statistics of water-works of Saginaw, Mich.

A CITY OF MEXICO dispatch says that the Mexican Central Railroad has been completed to Lagos, thirty-seven miles north of Leon and 295 miles from that city. The National Railroad will be completed to Naravatio, 126 miles from there, on Dec. 5. Both extensions will be opened to the public about Dec. 10.


CORRECTION TABLE
For Earthwork on Lateral Sloping Ground. To be used in addition to ordinary Embankment Tables.
Roadway 14'. Side Slopes 1½ to 1.
By V. WEBER.
cbyds. in 100ft.
Height of Embankment on Centre Line.

EARTH WORK CALCULATIONS.

EDITOR ENGINEERING NEWS:

The issue of Sept. 30 of your valuable paper contains a communication from Mr. Pellis concerning a method for the rapid calculation of earthwork. Before using said method, the cross sections must be plotted. But if the lateral slope of the ground is known, then it would save time, perhaps, by avoiding plotting, to use a graphical correction table in addition to ordinary earthwork tables. Such a correction table may easily be made according to the following principles:

Be n to 1 the lateral slope of the ground. Then the amount of earthwork given by an ordinary table for a given height $D\,M$ of profile will correspond with a surface $E\,T\,V\,G$, which is less than the real surface of the cross section by the triangle $A\,E\,F$.

What is the relation between this triangle, $A\,E\,F$, and the height, $D\,M$?

Be $E\,H$ the vertical height of $A\,E\,F$. Then we have:

$$\frac{A\,E\,F}{A\,C\,B}=\frac{E\,H^2}{C\,M^2},\text{ or }\frac{A\,E\,F}{A\,E\,F+E\,C\,G}=\frac{E\,H^2}{C\,M^2},\text{ or again,}$$

$$A\,E\,F.\ C\,M^2=(A\,E\,F+E\,C\,G)\,E\,H^2;\ A\,E\,F(C\,M^2-E\,H^2)=E\,C\,G.\ E\,H^2.$$

hence,

$$A\,E\,F=\frac{E\,C\,G.\ E\,H^2}{C\,M^2-E\,H^2}$$

But in case of side slopes of 1½ to 1 we have triangle

$$E\,C\,G=\frac{3}{2}\,C\,M^2,$$

also,

$$E\,M=\frac{3}{2}\,C\,M$$

and

$$E\,H=\frac{1}{n}\,E\,M=\frac{3}{2\,n}\,C\,M.$$

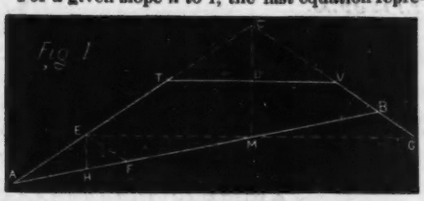
We have therefore

$$A\,E\,F=\frac{\frac{3}{2}\,C\,M^2.\left(\frac{3}{2\,n}\,C\,M\right)^2}{C\,M^2-\left(\frac{3}{2\,n}\,C\,M\right)^2}$$

or lastly,

$$A\,E\,F=\frac{\frac{3}{2}\,C\,M^2}{\left(\frac{2\,n}{3}\right)^2-1}$$

For a given slope n to 1, the last equation repre-



sents a parabola with the different heights $C\,M$ as ordinates, and the corresponding surfaces $A\,E\,F$ as abscissas. And the surface $A\,E\,F$ has only to be multiplied by 100 and divided by 27, to give the number of cubic yards to be added to the number of cubic yards given by the ordinary tables for a height $D\,M=C\,M-C\,D$.

Practically the correction table can best be plotted in the following way:

We calculate

$$A\,E\,F\times\frac{100}{27}$$

for a given height $C\,M$ in feet and a given lateral slope of n to 1, and mark the number of cubic yards thus obtained to a convenient scale on axis $A\,B$, $A\,M$ from A, the latter point being the apex of the parabola. $C\,M$ will be the ordinate at M. We draw now $A\,E$ at right angles with $A\,B$, through apex A, and making

$$A\,D=\tfrac{1}{4}C\,M,$$

have in $D\,C$ a tangent to the curve at C.

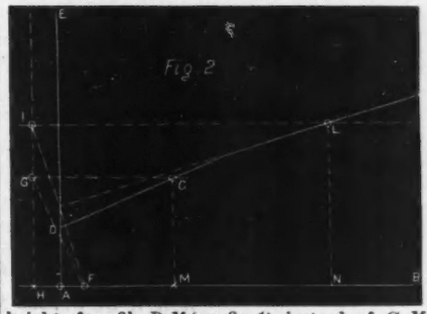
FG, at right angles with CD, through D, will mark at F, on AB, the focus, and at G, on a parallel line to AB, through C, a point of the directrix GH. The abscissa for another height, $C'M'$, as ordinate, can now easily be found by making IH, on GH prolonged, equal $C'M'$, join I with F and draw through the intersection K with EA, at right angles with IF, het line KL to the point L of intersection with a parallel line to AB through I. L is then a point of our parabola KL, tangent to the curve at L; $LN=IH=C'M'$, the chosen ordinate, and AN the abscissa, representing the number of cubic yards to be added for a height of profile

$$h=LN-CD.$$

A few points with their tangents thus plotted will be sufficient for drawing the curve.

The same way will lead to other parabolas answering to other slopes.

In order to enter the correction table with the



height of profile $D\,M$ (see fig. 1), instead of $C\,M$, we only have to measure the ordinates DM from a line parallel to the axis common to all the parabolas, and at a distance equal DC above it.

For a grade width of 14 ft. and side-slopes of 1½ to 1, we get

$$DC=\tfrac{3}{2}.\ \tfrac{1}{4}=4\tfrac{1}{2}\text{ ft.}$$

For any other width at grade we keep the same curves, and only move accordingly the line parallel to the axis. Yours respectfully,

V. WEBER, C. P. R.

WINNIPEG, Oct. 15, 1882.

BOOKS RECEIVED.

THE RAILROAD SPIRAL; or, the Theory of the Compound Transition Curve Reduced to Practical Formulæ, and Rules for Application in Field Work: with Complete Tables of Deflections and Ordinates for 500 Spirals. By Wm. H. Searles, C. E., M. A. Soc. C. E., author of Field Engineering. New York: John Wiley & Sons. 1882. Price, $1.50.

The author says in his preface that "the object of this work is to reduce the well-known theory of the cubic parabola, a multiform compound curve, used as a transition curve, to a practical and convenient form for ordinary field work." The book is for engineers. "The method described is that of transit and chain, analogous to the method of running circular curves; it is as simple in practice and as accurate in results." The book comprises eighty-five pages, and the notation followed is that of "Field Engineering." It is of convenient size for the pocket, and is substantially bound in morocco.

ANNUAL REPORT of the Chief of Engineers U. S. A., for the year ending June 30, 1882.

ANNUAL REPORT of the Chief Engineer of the Water Department of the City of Philadelphia for the year 1881.

THE N. Y. W. S. & B. RAILWAY, the new double track Direct Trunk Line between New York City and the Great Lakes; a pamphlet giving a statement of the affairs of the above railway, and submitted for the purpose of furnishing full and accurate information regarding the character and progress of the enterprise and the business upon which its prospects are based. Accompanied by an excellent map of N. Y. State, showing the location of the line. To be had at the office of the company, 15 Broad street, N. Y.

TEST OF BUILDING MATERIAL made at the Watertown arsenal, Mass., August, 1882, by the U. S. Ordnance Department, at the request of the Commissioners for the Erection of the Public Buildings in the city of Philadelphia, Pa., chiefly in reference to the material used in the New City Hall. With the compliments of Isaac S. Cassin, Commissioner.

JOURNAL OF THE ASSOCIATION OF THE ENGINEERING SOCIETIES for October. Contents: Chicago Cable Roads; the Smoke Nuisance; Steel Methods and Manufacture; a Flying Ferry in Washington Territory; Proceedings. Can be had by addressing H. G. Prout, 12 Barclay street, N. Y. 30 cents per number.

THE BUILDERS' GUIDE AND ESTIMATORS' PRICE BOOK being a compilation of current prices of lumber, hardware, glass, plumbers' supplies, paints, slates, stones, limes, cements, bricks, tin and other building materials; also prices of labor and cost of performing the several kinds of work required in building. Together with prices of doors, frames, sashes, stairs, mouldings, newels and other machine work. To which is appended a large number of building rules, data, tables and useful memoranda, with a glossary of architectural and building terms. By Fred T. Hodgson, editor of *The Builder and Wood Worker*, New York. The Industrial Publication Co., 1882. Price, $2.

This is a reference book especially intended for building contractors.

ANNUAL REPORT OF THE COMMISSIONER OF PATENTS for the year 1881.

From the Institution of Civil Engineers. Abstracts of papers in Foreign Transactions and Periodicals, Vol. LXX, Lesson 1881-82, Part IV. Boult and Potts in Seacombe Ferry Improvement Works.

Harvey on Coal Washing.

CORRESPONDENCE.

THE LONGEST RAILROAD TANGENT.

GREENSBORO, N. C., Dec. 1, 1882.

EDITOR ENGINEERING NEWS:

Will some of your numerous readers give length of the *longest tangent* on an operating railroad both in this country and Europe, and the name of road? Yours truly, R. P. A.

CONVENTIONAL COLORS.

PITTSBURGH, Pa., Dec. 4, 1882.

EDITOR ENGINEERING NEWS:

Referring to L. E. Vel's query in ENGINEERING NEWS of date of Oct. 28, "regarding the use of *colors* for the various lines of a railroad survey," I would say that in my practice, extending over a number of years, I have generally used the following:

For preliminary lines, *black*.
" location lines, *red*.
" changed or altered lines, *blue*.
" contours, *green*.
" property lines, dotted lines, shaded with *light red*.

Ground lines of profiles, *black*; and the grade lines, *red*. Respectfully, TRANSIT.

SPIRAL CURVES.

MANKATO, Minn. 21, 1882.

EDITOR ENGINEERING NEWS:

I would like to present a few arguments sustaining Mr. Reaugh in criticising the spiral curve as described in your issue No. 10 of this year.

Referring to the accompanying figure acb represents the spiral in question. A = sta. 20; b = sta.

21 and c = sta. 20×90. Ordinate, $cd=ac\times tan.\ cab=90\times tan.\ 12°=31$.

Now if Mr. Fry goes to b (sta. 21) and deflects 51½ from the long chord ab his telescope will *not* be tangent to the spiral for this reason: *Tan.* $51\tfrac{1}{2}'\times6d$ (or 10) = 15; which is less than the ordinate cd.

In other words the line of sight passes within the point on curve c. A. M. HAYNES.

LIFE OF A LOCOMOTIVE BOILER.

A locomotive boiler, it is calculated, will last until the engine has travelled over 350,000 miles. On some lines, however, the boiler, under favorable circumstances, particularly when pure water is used, may travel 400,000 or 500,000 miles before becoming unserviceable. Assuming that the life of the engine is determined by the endurance of the boiler, and that if under favorable circumstances it will last the 500,000 miles, then during that time it is estimated that the fire-box will probably require to be renewed at least three times, the tires of the wheels five or perhaps six times, the crank-axles three or four times, and the tubes from seven to ten times.—*Exchange*

FOND DU LAC, WISCONSIN, has no water-works. The inhabitants are supplied from artesian wells, varying in depth from 75 to 400 ft. The well holes and cisterns furnish a supply for fire purposes.

Contracts for cedar-block pavement in Toronto were let recently. The prices bid were: For pavement per square yard, 90 cents to $1.18, and for curbing per lineal foot, 23 to 27 cents.

Diagram of Average Heights

Corresponding to the true prismoidal content from a te

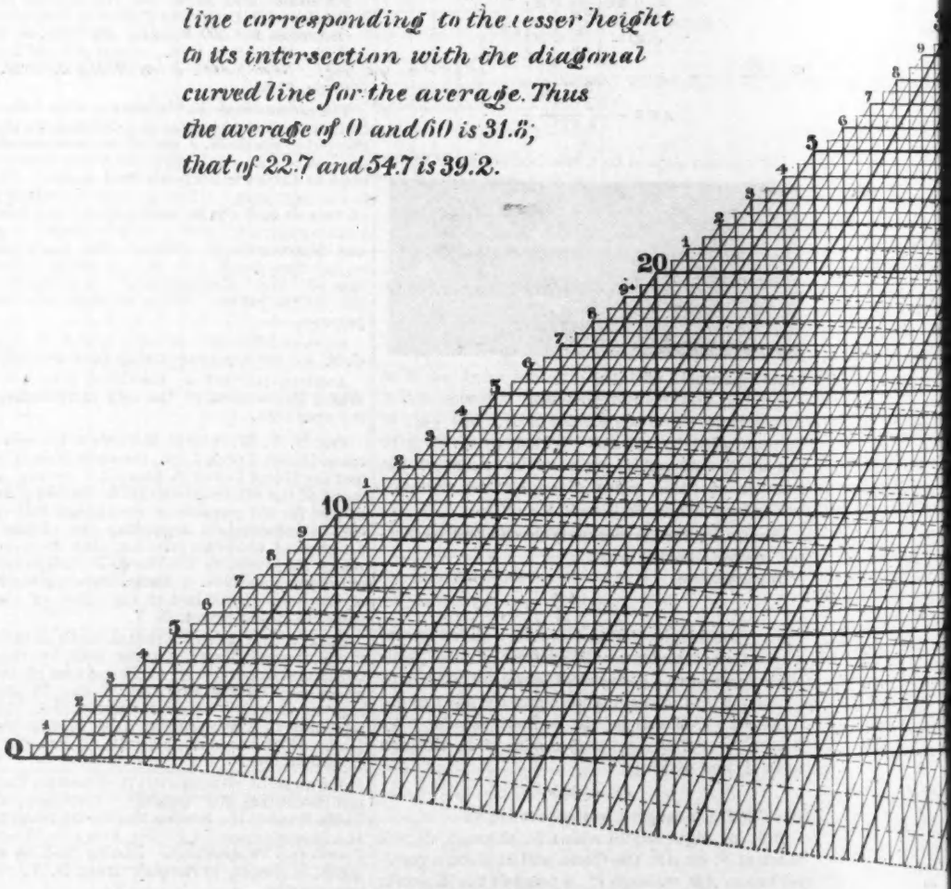
Formation 32 – 1½ to 1.

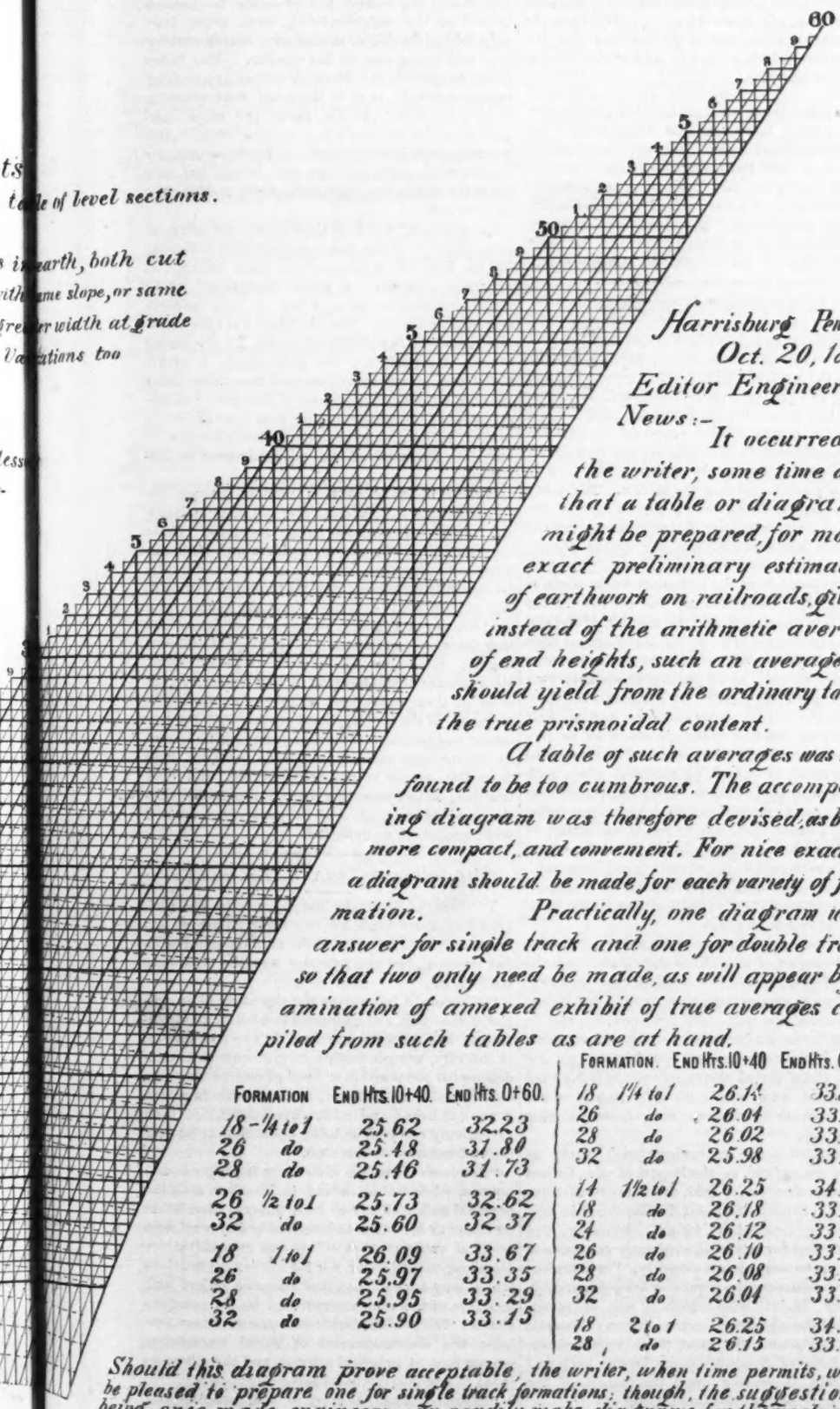
This diagram will serve for other double track formations in and fill, being a little in deficiency for less widths at grade with width at grade with flatter slope; and a little in excess for gre with same slope, or same width at grade with steeper slope. Va small to represent on diagram without confusion of lines.

Instructions.

For earthwork, follow the horizontal line corresponding to the less height to its intersection with the diagonal curved line corresponding to the greater height; the point of intersection marks the average height. Thus the average of 0 and 60 is 33.5; that of 13.3 and 45.5 is 32.7

For rock cuts, 26 – ¼ to 1, follow the dotted line corresponding to the lesser height to its intersection with the diagonal curved line for the average. Thus the average of 0 and 60 is 31.5; that of 22.7 and 54.7 is 39.2.





Harrisburg Penna.
Oct. 20, 1882.

Editor Engineering News:—

It occurred to the writer, some time ago that a table or diagram might be prepared, for more exact preliminary estimation of earthwork on railroads, giving, instead of the arithmetic average of end heights, such an average as should yield from the ordinary tables the true prismoidal content.

A table of such averages was soon found to be too cumbrous. The accompanying diagram was therefore devised, as being more compact, and convenient. For nice exactness, a diagram should be made for each variety of formation. Practically, one diagram will answer for single track and one for double track, so that two only need be made, as will appear by examination of annexed exhibit of true averages compiled from such tables as are at hand.

Formation		End Hts. 10+40.	End Hts. 0+60.
18	¼ to 1	25.62	32.23
26	do	25.48	31.80
28	do	25.46	31.73
26	½ to 1	25.73	32.62
32	do	25.60	32.37
18	1 to 1	26.09	33.67
26	do	25.97	33.35
28	do	25.95	33.29
32	do	25.90	33.15
18	1¼ to 1	26.14	33.84
26	do	26.04	33.56
28	do	26.02	33.50
32	do	25.98	33.37
14	1½ to 1	26.25	34.09
18	do	26.18	33.95
24	do	26.12	33.76
26	do	26.10	33.70
28	do	26.08	33.64
32	do	26.04	33.53
18	2 to 1	26.25	34.10
28	do	26.15	33.85

Should this diagram prove acceptable, the writer, when time permits, would be pleased to prepare one for single track formations; though, the suggestion being once made, engineers can readily make diagrams for themselves, to such scales as they may prefer.

Yours respectfully,
Wm. F. Shunk.

ENGINEERING NEWS
AND
AMERICAN CONTRACT JOURNAL.

Tribune Building. New York City.

GEO. H. FROST.....EDITOR AND PROPRIETOR.
S. D. V. BURR.....ASSOCIATE EDITOR.

SATURDAY, DECEMBER 9, 1882.

EDITORIAL ANNOUNCEMENTS.

Terms of Subscription.—To the United States and Canada, $4 per annum, including postage; all parts of Europe, $5, payable in advance. Remittances at the risk of the subscriber, unless made by registered letter or by draft, check or P. O. order, payable to GEO. H. FROST.

Terms of Advertising.—One inch, 12 lines, one insertion, $2; one month, $6.50; three months, $17; six months $30; one year, $50. Special rate for large space and long time will be given on application. Advertisements inserted for less than three months, payable in advance; for longer time, payable quarterly.

Articles for Publication in the current number should be received at the office of publication not later than Thursday morning, and advertisements not later than Friday noon.

Correspondence upon subjects which naturally belongs to the province of this journal is solicited.

CLUBBING ARRANGEMENTS.

1883.

In order to accomodate such of our subscribers as may wish to subscribe for other periodicals we offer the following terms: We will send to any address ENGINEERING NEWS at regular subscription price, $4.00, and the following at the additional prices given:

	Net Price.	Reg. Price.
Atlantic Monthly	$3.25	$4.00
Century Magazine	3.55	4.00
Harper's Magazine	3.25	4.00
Harper's Weekly	3.25	4.00
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Sanitary Engineer	2.75	3.00
Railroad Gazette (new subs.)	3.50	4.20
" " (renewals)	3.90	4.20
American Architect	5.00	6.00
Scientific American	2.65	3.20
Our Continent	3.25	4.00

The principal change in the above figures from those of last season is in that of the *Century Magazine*, which has advanced its trade price correspondingly. Our purpose is to bring the trade of our subscribers into this office, and to do this we give the clubbing journals at trade price and we add five cents to pay for stamps, stationery and time in handling the business. We wish it understood that we will extend this arrangement to any desired journal in the United States, so that our subscribers need not pay any attention to the claims of solicitors, who cannot offer any better terms.

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SHUNK'S AVERAGE HEIGHTS.—This valuable table which we publish to-day can be had on thick paper, at the price of twenty-five cents each, or five for one dollar.

OUR CLUBBING RATES.—We will send magazines or other periodicals subscribed for through us to *any address*. Our *subscribers* may send us the orders of their friends at our clubbing rates. We wish it to be especially noted that the Harpers do not give receipts; the sending of the publication subscribed for is considered as proof of receipt of money. Subscribers must not expect to receive their papers or magazines by return mail, but they ought to have them within a reasonable time according to distance from the office of publication; in case of non-arrival of magazine, or of the wrong one, write *direct to the office of publication*, specifying that it was subscribed and paid for through ENGINEERING NEWS; this is a busy season of the year in magazine and newspaper offices, and it takes time and care to clear off all orders rapidly and without a single mistake.

Special notice is called to the offer of the Weales' Series, *free*, advertised on another page. There are numbers which we do not expect any person will give shelf room to, but there are many valuable books in the list which are certainly worth the postage on them.

HOLIDAY BOOKS, ETC.—We have peculiar advantages for accommodating our subscribers at this holiday season of the year. The stores of this city are now overflowing with goods for holiday presents. To oblige our subscribers we will supply them with books from the catalogue of *any* publisher *during the present month only*, at a *discount of 20 per cent.* off retail rates. To this must be added postage at the rate of six cents on the dollar. Parties ordering must be subscribers to ENGINEERING NEWS.

ENGINEER'S BOOK OF TABLES.—We made a mistake in saying last week that these tables were calculated at Newburgh. They were calculated in the offices at Little Falls and this city; they were all checked over in the New York office and arranged for publication. We have already received orders for a large proportion of the present edition, which orders will be filled at once on receipt of the books from the office of *The Graphic* on Monday next.

TRIANGULATION STATIONS.

The fifth annual report of progress of the New York State Survey, lately issued, gives a description of the methods adopted for preserving and marking the trigonometrical stations. Wherever practicable an underground center mark, in the shape of a glazed earthen-ware pot, is planted, which bears upon its base the letters N. Y. S. S., and has a small hole in the center of the base to mark the precise center of the station. The depth of this earthen crock below the surface of the ground is about four feet. Above it is set a granite monument four feet long and six inches square, weighing about one hundred and eighty pounds, which projects about six inches above the surface. The letters N. Y. and S. S. are cut on two of the sides of this monument and the number of the station on another, while on the top diagonal lines are drawn whose intersection is vertically over the center mark. As an additional security two reference pots are planted at a distance of three feet from the station center, and one and one-half feet below the surface of the ground with arrows upon them pointing to the center. This method of marking must, of course, be modified when rock is struck near the surface. Then the center and reference points may be replaced by copper bolts, or rarely a center bolt may be put at the surface of the rock and the monument at one side where there is a sufficient depth of soil. In all cases careful notes of distances and directions to surrounding objects are taken, to enable the station to be discovered in future years.

The seventh annual report of the survey of the Adirondack region of New York shows also that the subject of monuments has received careful attention. In rock, copper bolts were used; in soil, heavy stone monuments with drill hole centers; and in a special instance a bowlder of quartzite weighing nearly a quarter of a ton was rolled to the spot and into it a nickel-plated copper bolt securely fastened with melted lead, while on the granite rocks around were carved deep sunken arrows pointing to the center.

The requisites for an underground mark, as stated in an article in the Report of the United States Coast Survey for 1868, are indestructibility, peculiarity, capacity to resist displacement in case it should be accidentally struck, cheapness, and want of value for any of the ordinary purposes of life as a protection against cupidity. For a surface mark or monument the requisites are permanency, durability, facility with which it can be recognized, and the absence of value for any domestic or farm purposes. To meet these requirements various forms of stoneware cones, blocks, bolts and monuments, depending upon the nature of the ground, have been devised and used.

There is another element that should receive careful consideration whenever the station is liable to be often visited; namely, the danger arising from human curiosity. There exists, it is true, in all countries and among all conditions of men, a certain degree of respect for a monument or landmark, due partly to ancient precepts and habits, and partly to the fact that the laws impose penalties for the malicious disturbance of property bounds and corners. But the element of curiosity seems often to be more powerful than that of respect. Surveyors who have planted monuments with underground marks, and have allowed the facts concerning the buried pot or crock to become known in the neighborhood, have often been surprised at the degree of curiosity manifested by boys and young men in the matter. The belief seems to prevail that the crock contains something rare or valuable, or it is supposed that there is some other object planted below the crock concerning which the truth has not been told. And not infrequently it happens that the boys actually excavate the earth, pull out the earthen pot, and finding nothing else, dash it to pieces in their disappointment.

The gnawing tooth of time causes the works of man to slowly decay and disappear from the earth, but the destruction effected by man, himself, is often the greatest. A stone monument might stand for centuries upon a hill if only nature's force acted upon it. But the plow cuts the earth away, and the boy delighted to dig for the buried crock. A copper bolt, and particularly a nickel plated one, stands little chance of remaining many years, if left projecting, or out of the rock. The preservation of the station is thus seen to be a difficult matter, yet much can be done in that direction if only the destructive force be recognized in advance.

Perhaps the most obvious plan to ensure the future recovery of the station would be to multiply the number of reference points around it. Holes may be drilled in rocks or bowlders and their distances and directions from the center of the station be carefully measured. Several monuments may be set at different distances from the central one. And instead of a single stoneware pot below the monument two or more might be buried at different depths. But to prevent the destructive effects of the curiosity of the boys it seems necessary that some of these operations should be conducted in secrecy. If the underground crocks, both for the center and for the reference monuments be buried by the surveyor and his assistants, without help from the people of the neighborhood, and if no tradition be left regarding them, it is probable that the stone monument will be properly respected and remain long unmolested.

THE PHILADELPHIA WATER-WORKS.

The letter of Secretary Murphy, of the Philadelphia Engineers' Club, led to a little ripple of excitement at the meeting of the club on last Saturday evening, and the outcome was the following resolution:

"Whereas, A letter over the signature of an official of this club, and addressed to a political organization, has recently appeared in the newspapers of this city, recommending certain parties as candidates for the position of head of one of the city departments, which letter, from the way in which it was published and commented upon, has been extensively received as being the action, or having the endorsement of this club.

"Resolved, That this club deem it proper to announce, while not intending to interfere with the personal action of any of its members; that it has no desire or intention to interfere in any way with political subjects; that it it is not responsible for the above-named letter, nor for similar publications which may appear; and that the sole object and province of this club as expressed in its constitution is: 'The professional improvement of its members; the encouragement of social intercourse among men of practical science, and the advancement of engineering in its several branches.'

"Resolved, That a copy of this preamble and resolution be furnished to the several newspapers of this city with a request to publish the same."

Mr. Murphy, in defence, called attention to the fact that he did not sign the letter as secretary of the club, nor did he date it from the club rooms.

At a conference meeting of members of the Se-

TABLE SHOWING COMPARATIVE COST OF MAINTENANCE OF PHILADELPHIA WATER-WORKS FROM 1861 TO 1881.

	McFADDEN.			GRAFF.	BIRKENBINE.	CASSIN.	BIRKENBINE.
	1881.	1878 to 1881.	1873 to 1881.	1867 to 1872.	1864 to 1866.	1862 and 1863.	1858 to 1861.
Yearly average in mill. galls. pumped 100 ft. with water power.	1 Year. 7.575	4 Years. 7.766	9 Years. 8.174	6 Years. 7.971	3 Years. 6.925	2 Years. 4.576	4 Years. 3.448
" " " " steam power.	26.673	22.938	17.814	6.902	4.785	5.516	4.937
" " " " Total	34.248	30.704	25.988	14.873	11.710	10.092	8.385
Per cent. by water	22 per cent.	26 per cent.	31.4	53.6	59	45.3	41.1
Per cent. by steam	78 per cent.	74 per cent.	68.6	46.4	41	54.7	58.9
Total yearly average cost of pumping, distribution and maintenance	$299,580.68	$253,728.56	$272,578.32	$180,283.77	$169,471.26	$108,645.79	$82,874 86
Cost per million gallons	8.74	8.35	10.47	12.12	14.47	10.77	9.88
Average height to which the water was lifted	151 ft.	148 ft.	145 ft.	118 ft.	113 ft.	116 ft.	115 ft.
Per cent. by steam power	78 per cent.	74 per cent.	68.6	46.4	41	54.7	58.9
Yearly average in millions of gallons consumed and pumped into basins at the lifts as given	22.721	20.709	18.000	12.534	10.338	8.716	7.267
Cost of maintenance per million of gallons distributed	$13.18	$12.25	$15.14	$14.38	$16.39	$12.46	$11.49

lect and Common Councils of Philadelphia, held behind closed doors on last Friday afternoon (1st inst.), Mr. Clay offered a resolution declaring that, in the opinion of the members of Councils there assembled, the interest of the city would be best subserved by the election of new men as the heads of the Departments of Highways, Water and Markets and City Property.

In the matter of the Water Department: "I have yet to hear," said Mr. Hollingsworth, "that the evidence that was produced in the Belmont investigation or at any other time has cast suspicion upon the integrity of Chief Engineer McFadden. For his competency the results of his administration should best speak. I know that the cost per gallon of pumping and distributing the water is, today, less by far than under any preceding chief engineer, and that the expenditures of every branch of the department have been decreased in proportion." The resolution passed in the three cases.

A resolution was then adopted requesting the Franklin Institute to present the names of six engineers, suitable candidates for Chief of the Water Department, three of them to be not members of the Institute.

We publish herewith a table showing comparative cost of maintenance of the Philadelphia Water-Works for the last 20 years. It will be observed that, with the same machinery, an enormous increase of plant to care for, better water service, increased average head of pumpage, and the proportion of the cheaper power (water) decreasing, yet the *total* cost of maintenance decreases per million gallons distributed. Evidently some councilmen wish a new deal of offices, and while they do not expect to get a better admistration of the Water Department than at present, yet they have friends who *must* be fed at the public crib.

PERSONAL.

A. H. KEATING, M. Inst. C. E., Chief Engineer of the City of Halifax, N. S., was at the meeting of the American Society of Civil Engineers, on Wednesday Evening. Mr. KEATING is visiting the New York and Philadelphia dry-dock yards, with a view to contemplated improvements in Halifax.

HENRY C. MURPHY, President of the Board of Trustees of the East River Bridge, died at his residence in Brooklyn, on the 1st inst. Mr. Murphy was born in Brooklyn in 1810. He graduated from Columbia College in 1830; was admitted to the bar in 1833; was elected Mayor of Brooklyn in 1842, and before his term expired was elected to Congress. In 1857 he was appointed Minister to the Hague. He drafted the first bill for the construction of the East River Bridge, and it was mainly due to his efforts that the bridge was built.

AMERICAN SOCIETY OF CIVIL ENGINEERS.

At a regular meeting, held on Dec. 6, Vice-President Paine in the chair, the following were elected members: Timothy Cookson Bradley, Assistant U. S. Engineer, St. Joseph, Mo.; Henry J. Gielow, Assistant U. S. Engineer, Town Creek, Ala.; Edward S. Safford, Division Engineer, New York, West Shore & Buffalo, and New York, Ontario & Western railroads, Newburgh, N. Y.; James Dix Schuyler, Chief Engineer and General Superintendent, Sinaloa & Durango Railroad, Culiacan, Sinaloa, Mexico; Thomas Wellington Spencer, Civil Engineer, Utica, N. Y.; Russell Thayer, Chief Engineer and Superintendent, Fairmount Park, Philadelphia, Pa.; Edmund Brownell Weston, Engineer in charge Water Department, Providence, R. I.

Mr. J. J. R. Croes, M. Am. Soc. C. E., described the progress that had been made in the procuring of supplies of water for cities and towns from subterranean sources, or "ground water," describing and illustrating the galleries, basins and wells which have been constructed in the United States within the last 13 years. The theory on which the first works of the kind were constructed was that a supply could be procured by filtration through the gravel of a bank of a river or pond. It was found, however, that more water came from the land side than the river, and that it was of a different character from the river water. It is now established that such supplies are furnished almost exclusively from the great underground streams or reservoirs, which are found in all the valleys of streams which are filled to a considerable depth with gravel. The failures and successes of many works were described, and the yield of filtering galleries discussed. The relative advantages of open and closed galleries were discussed, and it was shown that the experience of most places was decidedly against the advisability of open galleries or canals, on account of the growth of vegetation in them, although the water came from the gravel perfectly pure and cold, like spring water. An interesting discussion followed, in which Gen. George S. Greene, Mr. Joseph P. Davis, Mr. F. H. Keating, City Engineer of Halifax, and others participated.

LIVERPOOL ENGINEERING SOCIETY.

At the usual fortnightly meeting of the above Society held on Wednesday evening, 22d inst., at the Royal Institution, Colquitt st., Mr. N. Bramhall, Vice-President, in the chair, a paper was read by Mr. W. E. Mills, entitled "Notes on the Mallett System of Controlled Combustion." The author in introducing his subject stated that the question of dealing with the cloud of smoke hanging over our large cities, and the immense waste of heat which its presence testified to, had been attempted in many ways from time to time. All engineers were familiar with the different kinds of smoke consumers and fuel economizers which were before the public, but none of which altogether achieved the end aimed at, viz., the consumption of the smoke generated by the fuel in the furnace. Mr. Mallett, of Denver, Colorado, U. S. A., who had studied the subject, saw that the difficulty with all the smoke consumers was the impossibility of entirely burning all the atoms of carbon set free in the act of combustion. He conceived the idea, that if by any means the fuel could be burnt in such a manner as not to produce any smoke at all, and so preserve all the heat which would be otherwise wasted, a great step would be gained. He effected this in the following manner: A combustion chamber is fitted behind the boiler furnace, communicating with it by a perforated septum wall. The fire-bars were made hollow, and so arranged that cold air from the exterior could pass through them into the combustion chamber. The open ends of these firebars could be closed by a slide, worked by a lever, which also actuated the apertures in the ash-pit doors. When coal was first put on the fire, the latter openings were closed. The gases given off from the fuel passed into the combustion chamber through the apertures in the septum wall, and meeting there with the oxygen conveyed through the fire-bars were entirely consumed. The inventor claims that, by his method no smoke being produced, all chimneys may be done away with, and a saving of about forty-five per cent. in fuel effected. The necessary draught is provided by a fan which draws the heated gases, the ultimate products of combustion, through a condenser in which they are cooled down, and then discharged into the open air. The application of the system to stationary marine and locomotive boilers was next described, with the various scientific principles involved.

A discussion followed, and a vote of thanks was accorded to the author.

GENERAL INTELLIGENCE.

☞ *We solicit and are always pleased to publish in these columns any items of interest that may be furnished us.*

GAS AND WATER.

THE Department of Public Works of this city have received the following bids for furnishing the city's buildings with gas for the coming year: New York Gas Company, $1.50 per 1,000 ft., 18-candle power; Manhattan Gas Company, $1.50, 16-candle power; Harlem Gas Company, $2.25, 16-candle power; Metropolitan Gas Company, $1.50, 20 to 23-candle power; Municipal Gas Company, $1.75, 25-candle power.

THE system of water supply for North Borough, Mass., is completed and has cost $52,000.

ELECTRICITY.

A CABLE PROJECT.—TORONTO, Nov. 29.—The Great Northwestern Telegraph Company has elected Erastus Wiman, of New York, President, and appointed a committee to consider the project of laying a cable in Lake Superior.

PENNSYLVANIA has chartered the Postal Telegraph Company. The line is to run across the State from Wayne to Erie counties.

THE EMPIRE ELECTRIC LIGHT COMPANY, of New York, has been incorporated; capital, $100,000.

THE ELECTRIC LIGHT is about to be introduced at Allentown, Pa.

A NEW TELEGRAPH COMPANY.—Articles of incorporation of the New York & Pennsylvania Telephone and Telegraph Company were filed in the office of the clerk of this county. The new company is to construct, own and maintain a line or lines of electric telegraph between this city and Erie, Pa., the principal cities on the route being Elmira and Binghamton. Its capital stock is now $50,000, but this may be increased to $1,000,000.

THE Postal Telegraph Company, now engaged in putting up its lines between New York City and Chicago, has its poles all planted with the exception of 15 miles between Honesdale and Narrowsburg, and 150 miles of the line west of Cleveland, O.

RAILROADS.

GROUND has been broken at Eagle Pass, Tex., for the Mexican Pacific extension on Mexican soil.

A RAILWAY EXPOSITION.—The *Chicago Railway Age* announces that arrangements have been completed for a great national exposition of railway appliances to be held in Chicago in June, 1883.

NEW ROAD.—A movement is on foot at Shreveport, La., to organize a company to construct a narrow-gauge railway from Shreveport to a point in Arkansas, connecting with the Paramore system.

A DISPATCH from Hartford, Conn., states: A party of civil engineers, who have been at work in the vicinity of Meriden and who have evaded questions as to the purpose of their labor, are now said to be in the employ of the Delaware & Lackawanna Company, and to be surveying for a railroad between Springfield and New York parallel to the New York, New Haven & Hartford road.

THE route of the Manitoba, Pembina & Grand Forks Railroad, which has been incorporated, begins from a point on the international boundary line between the United States of America and the Dominion of Canada, not more than three miles west of the Red River of the North to the city of Grand Forks, Dak. It will be constructed as near as practicable to the western banks of the Red River of the North, and between the Red River and the present constructed line of the St. Paul, Minneapolis and Manitoba Railroad. The estimated length of said railroad is eighty miles, and is to run through the counties of Pembina, Wabash and a portion of Grand Forks. The capital stock of the corporation, $1,000,000.

TRACK CHANGED.—The track of the Pittsburgh & Western Railroad was changed on Sunday from narrow to standard gauge. The road is nearly fifty miles long, and the work was done in fifteen hours.

THE Paramore narrow-gauge system is completed from Cairo, Illinois, to Gatesville, Texas, with the exception of a gap in the White River Valley, which is to be closed this month.

MEXICAN SUBSIDIES.—CITY OF MEXICO, Dec. 4.—In an editoral which it is understood reflects the opinion of the Mexican Government, the *Two Republics* says: "While the Government is desirous to settle the English debt, it will not assume any burden which may prevent it from meeting its engagements with American and Mexican railroad companies.

NEW ILLINOIS ROAD.—Articles of incorporation have been filed by a new railroad, starting from Springfield and running to some point in Jackson County.

THE ST. LOUIS & TEXAS narrow gauge road has now 300 cars running with straight tread wheels, and it is claimed that they run more easily than the coned wheels and with at least equal safety.

ROAD FOR SALE.—WILMINGTON, Del., Nov. 28.—The Dorchester & Delaware Railroad, 37 miles long, connecting Seaford, Delaware and Cambridge, Md., was offered at public sale at Cambridge this morning. Only $22,000 being bid the road was withdrawn.

THE CANADIAN PACIFIC railway has raised its capital from $15,000,000 to $100,000,000.

THE New York Elevated Railroad Company sent to Mayor Grace a copy of the Court of Appeals' decision in the case of Rufus Story against the company, and the following remarks signed by Vice-President Gallaway: "Inasmuch as the company acquired its right to such use and occupancy of certain streets as is necessary to railway service, for a compensation in money, under a contract between it and the city which declared that the payment thereof shall be the legal compensation in full, for the use and occupancy of the streets, by said railway, as provided by law, it now calls upon the city to defend the rights of the company under this contract. If it shall be compelled to make compensation to abutting owners for its use and occupancy of the streets, it will claim that the compensation should be paid by the city With this view it invites the city to take part in the defence of the company against suits for such compensation; and respectfully gives notice that whatever it may be compelled to pay it will reclaim from the city." The Mayor sent the letter to the Corporation Counsel, with instructions to protect the city against the claims of the company, if he finds them not well founded.

TEXAS RAILROAD NOTES.—Progress on the Southern Pacific Railroad in Texas is very slow. It is thought a junction will be formed, and through trains will be in operation not before January 1. The construction gangs are now in the centre of a wild, mountainous country, and the survey of the road leads across deep cañons and through high mountains, or makes sharp cuts around them. The locality is about 225 miles from San Antonio. The track-layers are only a few miles apart. The northern party is 407¼ miles from the bridge across the Rio Grande, near El Paso. Travel is fair on the Atlantic & Pacific road from Mojave to Calico. Work on the road is going forward rapidly. Track-layers and graders are out about 55 miles east of Calico Station. A dispatch from San Antonio states that Capt. W. S. Monroe has been awarded the contract for grading, track-laying, bridging, etc., for 100 miles into Mexico by the Mexican Pacific Construction Company, composed of Col. Huntington, Crocker, Pierce, and others. C. P. Huntington has purchased the Rio Grande and Pecos Railway, now being built through the rich coal-fields between Laredo and Eagle Pass.

TO BE DOUBLE-TRACKED.—It is authoritatively stated that the Naugatuck Railroad, between Waterbury and Bridgeport, Conn., will have a double track next spring. The road-bed will be prepared at once.

A PENNSYLVANIA ROAD.—It is expected that work on the Conewago Valley Railroad will be resumed vigorously at an early day. It is now completed as far as Redsecker's mill.

RAILROAD COMPLETED.—The Kansas City, Fort Scott & Gulf Railroad is completed to Van Buren and Fort Smith, Ark.

CONTRACTS LET.

THE contract for slating and galvanizing the public building at Charlestown, W. Va., has been awarded to Knisely Brothers & Miller, of Chicago, and for the heating apparatus of the Paducah building to Bartlett, Hayward & Co., of Baltimore.

BUILDING.

A COURT HOUSE, to cost $40,000, is in course of erection in Breckenridge, Minn.

NEW GOVERNMENT BUILDINGS.—The government has accepted deeds of ground for a new custom-house and post-office building at Council Bluffs, Ia.

BRIDGES.

A NEW BRIDGE is to be erected over Flushing Creek Long Island.

THE bridge across the Arkansas River at Arkansas City is almost completed.

PROPOSED NEW BRIDGE IN VIRGINIA.—The Board of Supervisors of Stafford County met in Falmouth recently and made an order authorizing the issue of $20,000 in county bonds for the purpose of building a free bridge across the Rappahannock, at Fredericksburg; bonds to be registered to date from Jan. 1, 1883, and bear six per cent. interest, payable semi-annually.

THE BOSTON BOARD OF ALDERMEN on the 4th inst. passed an order authorizing the borrowing of $400,000 to be expended in the relocation and widening of Warren Bridge.

MISCELLANEOUS.

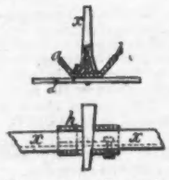
MILL STOPPED.—The managers of the North Chicago Rolling Mill Company state that their mill in North Chicago, which recently shut down, will probably never be opened again for the purpose of rolling steel rails, but will be devoted to other classes of iron work. All the steel rail work will be done hereafter in the mills in South Chicago.

TRUSS-BRIDGES.*

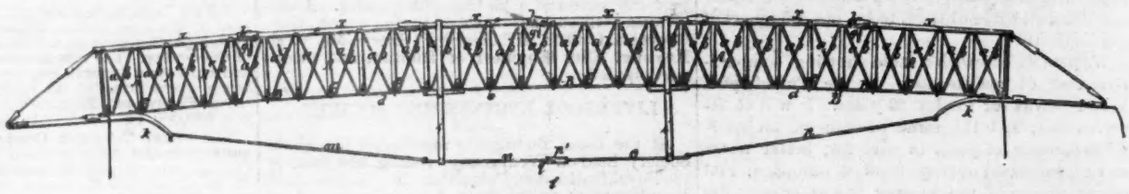
AN ILLUSTRATED HISTORICAL DESCRIPTION OF ALL EXPIRED PATENTS ON TRUSS BRIDGES, WHICH UNDER THE LAW ARE NOW PUBLIC PROPERTY AND FREE TO BE USED BY ANY ONE.

By F. B. Brock, Patent Attorney, Washington, D. C.

November 6, 1845, Nathaniel Rider, of Massachusetts, devised a truss bridge, shown by the drawings, in which *A* denotes the posts arranged upon the sills *B*. Each sill is supported by two iron tension braces, *a b*, united beneath the sill, and diverge therefrom upwardly. The tension bar *b* of each panel is connected at the top of a post to the bar *a* of the panel adjacent. Another chord or stringer of plate iron, *d*, extends beneath the sills and the tension braces, and is bolted to the sills. A wedge, *e*, is placed between the foot of each post and the sill. By driving in the wedge, the post will be elevated and the tension braces of each of the bars *a b* of any two panels equally strained. The tension braces and chords are made of wide plate iron.



DETAILS OF RIDER'S BRIDGE.



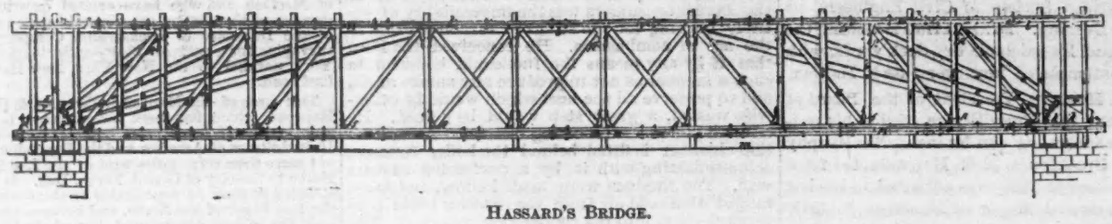
RIDER'S TRUSS BRIDGE.

A device for cambering the bridge is shown. A series of wedges, *g*, are interposed between the adjacent sections of the upper chord bars *x*, which have lapping socket bands *h*.

Iron posts, *i r*, extend below the chord *d*. To the lower strings also are applied two bent bars, *k k*. A cambering chain, *m n o p*, passes under the posts *i r*, which are provided with friction rollers, and is secured to the bars *k k*. It will be seen that when the bridge is cambered or sprung upwardly by means of the cambering chains, provision is also made for the distension of the upper chord. The bars *k* admit of endwise movement of the abutments when the bridge is elevated.

January 15, 1846, Thomas Hassard, of New York, patented a railroad truss-bridge. His object was to provide a means for compensating for any shrinkage of the parts connected with the inclined braces, which he effects by introducing wedges through a shoe at the foot of each brace; and secondly, the manner of combining the arch pieces with the structure, so as to give equal strains to all the parts of the bridge

The chords *a* consists of three strings, each composed of three tiers of timber. Between these three strings are introduced the posts *c*. Bolts *n* pass through the chords by the side of each post, and provide means for removing the post should occasion require. The upper chord *b* has but two tiers of timber, and is otherwise constructed like the lower chord. At the foot of each post are placed cast iron shoes, *A* having side flanges *f*, and bottom flanges. These shoes take the feet of the braces *d* and the heads into metal caps *A'*.



HASSARD'S BRIDGE.

An abutting block, *k*, is placed above the pin or abutment, back of which is placed a sustaining block, 4. A ledge piece, *r*, and stay bolt *s*, complete the connection of these parts. The block *k* has a series of steps, 3 3, which receive the ends of the arch braces *e e*, which extend in diagonals successively rising above each other, until each terminates at its top in contact with an intermediate string piece in contact with the upper chord timbers.

(TO BE CONTINUED.)

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